REMARKS

This application has been reviewed in light of the Office Action dated January 14, 2003. Claims 1-8 and 10-24 are presented for examination. Claims 9 and 25-104 have been cancelled, without prejudice or disclaimer of the subject matter presented therein. Claims 1, 10, 15, and 20, the independent claims, have been amended to define more clearly what Applicants regard as their invention. Favorable reconsideration is requested.

Applicants note with appreciation the indication that claims 3, 4, 8, 12, 13, 17, 18, 22, and 23 would be allowable if rewritten so as not to depend from a rejected claim, and with no change in scope. These claims have not been so rewritten because, for the reasons given below, their base claim is believed to be allowable.

Claims 1, 2, 5-7, 9-11, 14-16, 19-21, and 24 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,054,100 (*Tai*).

As shown above, Applicants have amended independent claims 1, 10, 15, and 20 in terms that more clearly define what they regard as their invention. Applicants submit that these amended independent claims, together with the remaining claims dependent thereon, are patentably distinct from the cited prior art for at least the following reasons.

The present invention is directed to resolution conversion of multi-dimensional digital data, such as digital image data. In conventional systems, some commonly used continuous kernels for interpolation are the nearest neighbor (NN), linear, quadratic, and cubic kernels. Each of these kernels has its own weakness, such as shifting edge locations which often produce visible distortions in the output image when using the NN kernel. Also, simply applying a single continuous convolution kernel at every image pixel will not satisfy all of the

requirements for a general-purpose resolution conversion application. A further problem with conventional continuous convolution kernels is with their application to edges at oblique orientations in the image plane. When encountering a pixel with an oblique edge, pixels on either side of the edge are primarily used in the interpolation, rather than pixels along the edge. This results in an interpolated edge that appears jagged, or blurred, or both.

The aspect of the present invention respectively set out in independent claims 1, 10, 15, and 20 addresses the foregoing problems in that the interpolation kernel is selected depending on an edge strength indicator, an edge direction indicator, and a local contrast indicator for each discrete sample value of a first set of discrete sample values. By virtue of this arrangement, it is possible to select different interpolation kernels depending on the different factors noted above. Specifically, the invention defined in the independent claims allows detecting and handling text regions during interpolation, where the interpolation kernel is selected based on a local contrast indicator. Support for this feature is found at least at page 10, lines 20-24 of the specification, which states that local contrast between neighboring pixels is used as the basis of text region detection. Text regions are usually regions where the local contrast is high, the number of colors is limited, and the texture is simple. Accordingly, these local contrast indicators allow detection of multilingual text information rendered in a high contrast fashion.

Independent claim 1 is now directed to a method of interpolating a first set of discrete sample values to generate a second set of discrete sample values using one of a plurality of interpolation kernels. The interpolation kernel is selected depending on an edge strength

indicator, an edge direction indicator, and a local contrast indicator for each of the discrete sample values of the first set.

A notable feature of claim 1 is that the interpolation kernel is selected depending on an edge strength indicator, an edge direction indicator, and a local contrast indicator for each of the discrete sample values of the first set.

Tai, as understood by Applicants, relates to electronic photocopiers and printers which digitally enlarge and reduce an image defined by stored gray-level values. *Tai* teaches interpolating existing gray-level pixel data to obtain new pixel values during image enlargement and reduction. In particular, at column 5 of *Tai*, a bilinear interpolation equation is disclosed (Equation 5). This equation includes modifying factors which are used to modify weighting factors depending upon the location of new and existing pixels. As disclosed at column 5, lines 55-59, these modifying factors are assigned values in the calculations depending on the edge strength of the image edge in the corresponding directions. Further, at column 6, lines 8-11, an edge of high contrast in an image data is recognized and the equation (Equation 5) is modified to provide a value for a new pixel. However, nothing has been found in *Tai* that teaches or suggests that the interpolation kernel is selected depending on an edge strength indicator, an edge direction indicator, and a local contrast indicator for each of the discrete sample values of the first set, as recited in claim 1. For these reasons, claim 1 is believed to be clearly patentable over *Tai*.

Independent claims 10, 15, and 20 are method, apparatus, and computer readable medium claims, respectively, corresponding to method claim 1, and are believed to be

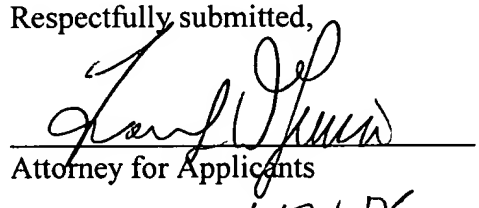
patentable over Tai for at least the same reasons as those discussed above in connection with claim 1.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons as are those independent claims. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual reconsideration of the patentability of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,



Attorney for Applicants

Registration No. 47,476

FITZPATRICK, CELLA, HARPER & SCINTO
30 Rockefeller Plaza
New York, New York 10112-3801
Facsimile: (212) 218-2200
NY MAIN 349112

MARKED-UP VERSION SHOWING CHANGES MADE TO CLAIMS

1. (Amended) A method of interpolating a first set of discrete sample values to generate a second set of discrete sample values using one of a plurality of interpolation kernels, [characterised in that] wherein said interpolation kernel is selected depending on an edge strength indicator, an edge direction indicator and [an edge context] a local contrast indicator for each of said discrete sample [value] values of said first set.

9. (Cancelled)

10. (Amended) A method of interpolating image data, said method comprising the steps of:

accessing a first set of discrete sample values of said image data;

calculating kernel values for each of said discrete sample values using one of a plurality of kernels depending upon an edge orientation indicator, an edge strength indicator, and [an edge context] a local contrast indicator for each of said discrete sample values; and

convolving said kernel values with said discrete sample values to provide a second set of discrete sample values.

15. (Amended) An apparatus for interpolating image data, said apparatus comprising:

means for accessing a first set of discrete sample values of said image

data;

calculator means for calculating kernel values for each of said discrete sample values using one of a plurality of kernels depending upon an edge orientation indicator, an edge strength indicator, and [an edge context] a local contrast indicator for each of said discrete sample values; and

convolution means for convolving said kernel values with said discrete sample values to provide a second set of discrete sample values.

20. (Amended) A computer readable medium for storing a program for an apparatus which processes data, said processing comprising a method of interpolating image data, said program comprising:

code for accessing a first set of discrete sample values of said image data;

code for calculating kernel values for each of said discrete sample values using one of a plurality of kernels depending upon an edge orientation indicator, an edge strength indicator, and [an edge context] a local contrast indicator for each of said discrete sample values of said first set; and

code for convolving said kernel values with said discrete sample values to provide a second set of discrete sample values.

25-104. (Cancelled)